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Integrated water resources management: evolution, prospects and future challenges

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This paper analyzes the evolution of the concept of Integrated Water Resources Management (IWRM) at international conferences over the past three decades and addresses the prospects of IWRM in resolving the current water crisis. It also identifies seven crucial challenges to implementing IWRM. Our rivers and aquifers are the life-blood of the planet. To achieve sustainable development, we must manage our most vital natural resource, water, in an integrated manner, or precisely through Integrated Water Resources Management. Since water is fundamental to many aspects of life, and to the surrounding natural environment, there is a need not only to review IWRM's evolution in the last three decades, but also to identify future challenges to its implementation.

KEYWORDS: water resources, water management, sustainable development, conferences, international agreements, rivers, world problems, developing countries, water conservation

Introduction

In 2002, at the Johannesburg World Summit on Sustainable Development (WSSD), The Technical Advisory Committee of the Global Water Partnership defined Integrated Water Resources Management (IWRM) "as a process, which promotes the coordinated development and management of water, land and related resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems," and emphasized that water should be managed in a basin-wide context, under the principles of good governance and public participation.

Historically, we can go back centuries, if not millennia, to discover forerunners of the present IWRM paradigm. In a number of countries, water management has been institutionalized in an advanced and integrated way over centuries. In Valencia, Spain, for example, multi-stakeholder, participatory water tribunals have operated at least since the tenth Century. Embid (2003) writes that Spain was probably the first country to organize water management on the basis of river basins, as it adopted the system of confederaciones hidrográficas in 1926. Over the last several decades,

there have been serious attempts to implement IWRM in different global regions. In the 1940s, an early version of IWRM occurred when the Tennessee Valley Authority began to develop the water resources for that region (Barkin & King, 1986; Tortajada 2004). A later example occurred in 1960 in Hessen, Germany, where Integrated Water Resources Management Planning was prepared on the basis of a multidisciplinary integrated approach (Berg, 1960, cited in Kaitera, 1963).

At the United Nations Conference on Water in the Mar del Plata (1977), IWRM was the recommended approach to incorporate the multiple competing uses of water resources. Although in the 1980s, water disappeared, for the most part, from the political agenda, the situation changed in the 1990s, thanks to the efforts of a number of conferences and international organizations. Efforts such as the International Conference on Water and Environment (1992), Second World Water Forum (2000), International Conference on Freshwater (2001), World Summit on Sustainable Development (2002) and Third World Water Forum (2003) collectively led to breakthroughs that thrust IWRM onto the political agenda.

Driven by the question of the main challenges to implementing IWRM, this paper reviews the evolution of IWRM as a concept from Mar del Plata 1977 to Kyoto 2003 and address the prospects of IWRM in resolving current water crises. It then identifies seven crucial—but often overlooked—challenges in current practice, which should be addressed when implementing IWRM.

IWRM in the International Agenda FROM Mar del Plata 1977 to Kyoto 2003

A critical review of the evolution of IWRM in the international agenda, from the UN Conference on Water held in Mar del Plata in 1977 to the Third World Water Forum of Kyoto in 2003, follows.

United Nations Conference on Water (Mar del Plata 1977)

In 1977, the UN Conference on Water was held in Mar del Plata, Argentina. Its goals were to assess the status of water resources; to ensure that an adequate supply of quality water was available to meet the planet's socio-economic needs; to increase water use efficiency; and to promote preparedness, nationally and internationally, so as to avoid a water crisis of global dimensions before the end of twentieth century.

The conference approved the Mar del Plata Action Plan, which was the first internationally coordinated approach to IWRM. The plan had two parts: a set of recommendations that covered all the essential components of water management, and twelve resolutions on a wide range of specific subject areas. It discussed assessment of water use and efficiency; natural hazards, environment, health and pollution control; policy, planning and management; public information, education, training and research; and regional and international cooperation (Biswas, 2004).

The Mar del Plata conference was a success, in part due to the active participation of the developing world and the discussions on various aspects of water management, specifically the country and region specific analyses. The conference considered water management on a holistic and comprehensive basis, an approach recognized as one of the key IWRM issues in the 1990s. To provide potable water and sanitation facilities to all, and to accelerate political will and investment in the water sector, the conference recommended the period 1980 to 1990 as the International Water Supply and Sanitation Decade.

The Mar del Plata conference was undoubtedly a major milestone in the history of water resources development for the 20th century. Viewed from any direction, the conference has become an important yardstick in water resources management, particularly for IWRM. Regrettably, transboundary water resources management was not discussed comprehensively, and an implementation scheme for the Action Plan was not developed during the discussion (Biswas, 2004).

While the 1980s were key as far as implementing the Mar del Plata principles, gradually, water faded from international agendas, so much so that the Brundtland Commission Report (WCED, 1987), which laid the cornerstones to the concept of sustainable development in international policy, hardly addressed the issue of water.

International Conference on Water and Environment - Dublin 1992

Fifteen years after the Mar del Plata Conference, water was back on the international agenda. In January, 1992, the International Conference on Water and the Environment (ICWE) was held in Dublin, Ireland to serve as the preparatory event, with respect to water issues, to the Rio United Nations Conference on Environment and Development (UNCED) Conference.

The Dublin Conference was expected to formulate sustainable water policies and an action program to be considered by UNCED. The conference reports set out the recommendations for action at the local, national, and international levels, based on the following four guiding principles (ICWE, 1992):

- Principle one recognized fresh water as a finite, vulnerable, and essential resource, and suggested that water should be managed in an integrated manner.
- Principle two suggested a participatory approach, involving users, planners, and policymakers, at all levels of water development and management.
- Principle three recognized women's central role in the provision, management, and safeguarding of water.
- Principle four suggested that water should be considered as an economic good.

The fourth principle became highly debated and was opposed by water professionals from the developing world. They argued that no water development initiatives could be sustainable if water was considered an economic good without considering the issues of equity and poverty.

The main successes of the Dublin conference were that it focused on the necessity of integrated water management and on active participations of all stakeholders, from the highest levels of government to the smallest communities, and highlighted the special role of women in water management. The Dublin conference recommendations were later consolidated into Chapter eighteen of Agenda 21 in Rio de Janeiro, 1992.

The major limitations of the Dublin conference were that it was, for the most part, a meeting of experts rather than an intergovernmental meeting, and that it did not consider the outcomes of Mar del Plata. Unlike Mar del Plata, there was a lack of active participation from the developing world, which was later heavily criticized. Many water professionals and

decisionmakers from the developing world not only criticized the Dublin principles, especially the fourth, but also criticized the failure of the participants to indicate how the principles could be implemented in the context of complex water management scenarios in the developing countries.

The shortcomings of the Dublin Principles would later be addressed in the Second World Water Forum and the concurrent Ministerial Conference in 2000. In spite of the aforementioned problems, current thinking regarding the crucial issues of IWRM is heavily influenced by the Dublin Principles.

Second World Water Forum & Ministerial Conference (The Hague 2000)

On 17-22 March 2000, the Second World Water Forum was held in The Hague, the Netherlands, with more than 5,700 participants from all over the world. Unlike Mar del Plata and Dublin, this Forum did not just gather intergovernmental participants and experts, but included a range of stakeholders related to water management from the developing and developed world. This would become key to the Forum's success, and to its participants' satisfaction.

With its theme, *From Vision to Action*, the Forum brought together a wide array of documents addressing visions produced and structured by the World Water Council and invaluable views in reforming the water sector, better addressing the need to integrate water management. Unlike Dublin, The Hague Forum carefully considered the outcomes of previous water initiatives and acknowledged water's social, environmental, and cultural values.

The participants of The Hague forum suggested applying equity criteria, along with appropriate subsidies to the poor, when systematically adopting full-cost water pricing. The Forum acknowledged that food security, ecosystem protection, empowerment of people, risk management from water related hazards, peaceful boundary and transboundary river basin management, basic water demands, and wise water management are achievable through IWRM.

To meet the challenges related to IWRM, the Ministerial Declaration (WWC, 2000) called for institutional, technological, and financial innovations; collaboration and partnership at all levels; meaningful participation of all stakeholders; establishment of targets and strategies; transparent water governance; and cooperation with international organizations and the UN system.

"Making Water Everybody's Business" was another theme. Water privatization and public-private partnerships were widely promulgated as means to achieve the vision objectives. However, many water professionals opposed privatization, arguing that the water sector is interrelated to many functions that demand government presence, i.e. flood control, drought alleviation, water supply, and ecosystem conservation (Shen & Varis, 2000).

The Forum also acknowledged that the right to land and access to water is key to breaking out of the poverty trap. Moreover, it was pointed out that water could empower people, and women in particular, through a participatory management process.

Unlike Mar del Plata and Dublin, at the Hague Forum the main challenges to implementation were discussed extensively and, afterwards, the Forum's visions were converted into action programs for the participating countries. This led to the birth of the Global Water Partnership, which now plays a central role in coordinating the *Framework for Action*.

The Second World Water Forum was successful not only for putting IWRM on the political agenda, but also for endorsing the active participation of the developing world's water stakeholders, and for gathering world water leaders and communities together.

International Conference on Freshwater - Bonn 2001

In close co-operation with the United Nations, Germany hosted, in December 2001, the International Conference on Freshwater in Bonn. The aim of the conference was to contribute to solutions for global water problems, and to support preparations for the World Summit on Sustainable Development (WSSD) in Johannesburg, 2002, and the Third World Water Forum in Kyoto, 2003.

The conference reviewed all previous water resources development principles and recognized that there was often a gap between policy development and practice. In a novel way, the Bonn Conference focused on practical implementation, not only identifying challenges and key targets, but also recommending action programs to implement policies in the field (ICFW, 2001).

The Bonn Keys, which summarized the conference discussions, highlighted the key steps toward sustainable development through meeting water security needs of the poor, and promoting decentralization and new partnerships. To achieve these steps, it suggested IWRM as the most capable tool.

The Bonn Conference recommended prioritizing actions in the fields of governance, mobilizing financial resources, building capacity, and sharing knowledge. The *Bonn Recommendations for Action* addressed, at the lowest appropriate level, issues such as poverty, gender equity, corruption mitigation, and water management. The Conference identified a set of actions necessary to mobilize financial resources: strengthening public funding capabilities, improving economic efficiency, and increasing official assistance to developing countries. In the field of capacity building, it prioritized the need for education and training regarding water wisdom, research, effective water institutions, knowledge sharing, and innovative technologies. The Conference also recommended that WSSD harmonize water issues with overall sustainable

development objectives and integrate water into national poverty reduction strategies.

The Bonn Conference should be commended by the water world for connecting the views of the developing and developed world and impartially divulging practical implementation problems. It also provided action programs, a historical milestone for making IWRM truly effective in the field. The key success of the Bonn Conference was the adoption of the *Bonn Recommendations* in the *WSSD Plan of Implementation* (WSSD, 2002).

World Summit on Sustainable Development - Johannesburg 2002

The World Summit on Sustainable Development (WSSD), held in Johannesburg, South Africa, in 2002, should be recognized as a success because it put IWRM at the top of the international agenda.

The *WSSD's Plan of Implementation* includes IWRM as one of the key components for achieving sustainable development. It provides specific targets and guidelines for implementing IWRM worldwide, including developing an IWRM and water efficiency plan by 2005 for all major river basins of the world; developing and implementing national/regional strategies, plans, and programs with regard to IWRM; improving water-use efficiency; facilitating public-private partnerships; developing gender-sensitive policies and programs; involving all concerned stakeholders in a variety of decisionmaking, management, and implementation processes; enhancing education; and combating corruption.

For the most part, it seems that the Bonn Conference recommendations were adopted within WSSD, and IWRM has now become the most internationally accepted water policy tool. The WSSD outcomes also encouraged major donors to commit themselves to implementing IWRM in the developing world. A number of broad strategic partnerships were declared at Johannesburg; the EU, in particular, launched a series of partnerships on Water for Sustainable Development with Africa, Eastern Europe, the Caucasus, and Central Asia.

The international political recognition, at WSSD, of IWRM as the mechanism to achieve sustainable water management will dramatically and positively change the water world for the years to come. It is probable that IWRM will become the most integral part of all water initiatives, as was observed at the third World Water Forum in Kyoto, 2003.

The Third World Water Forum - Kyoto 2003

Over 24,000 people from around the world attended the third World Water Forum, held in March 2003 in Kyoto, Japan. The key issues were safe, clean water for all, good governance, capacity building, financing, public participation, and various regional topics (TWWF, 2003a). A two-day Ministerial conference resulted in the release of a ministerial

declaration on a range of water issues, including water resource management, safe drinking water and sanitation, water for food and rural development, water pollution prevention and ecosystem conservation, as well as disaster mitigation and risk management (TWWF, 2003b).

The forum again recommended IWRM as the way to achieve sustainability regarding water resources. The ministerial declaration addressed the necessity of sharing benefits equitably, engaging with pro-poor and gender perspectives in water policies, facilitating stakeholder participation, ensuring good water governance and transparency, building human and institutional capacity, developing new mechanisms of public-private partnership, promoting river basin management initiatives, cooperating between riparian countries on transboundary water issues, and encouraging scientific research.

The ministerial declaration also vowed support to enable developing countries to achieve the UN Millennium Development Goals, and for developing IWRM and water efficiency plans in all river basins worldwide by 2005, the target set at the World Summit on Sustainable Development (TWWF, 2003b). Putting stakeholders and water ministers from around the world together in a Multi-Stakeholder Dialogue (MSD) table for the first time in water history was another key achievement. In addition, a proposal to establish a network of websites to follow the Portfolio of Water Actions received the fullest support of all participants. This will result in information sharing and promote cooperation between countries and international organizations.

A range of organizations and countries—including the World Water Council, Global Water Partnership, UNESCO, UN-HABITAT, FAO, UNEP, IUCN, UNICEF, Australia, the Netherlands, the EU, and Japan—made commitments to develop the water sector. Over 100 such commitments have been confirmed, and this number could double (TWWF, 2003a).

IWRM: Overly General Maxims Must Be Avoided

Seven Factors Towards a Successful IWRM Implementation

The last three decades of summits and mega-conferences were essential in raising the international community's awareness of the urgency of integrated water management. Over time, wise water management has been recognized as an effective way to improve quality of life. Three decades of conferences have resulted in many commitments to IWRM that, unfortunately, were often not implemented.

Although IWRM is the current buzzword of water resources development, future challenges remain in reducing the gap between theoretically agreed policies and implementation.

The integration of different sectors related to water management is very challenging. Moreover, the problems and solutions associated with IWRM implementation in different regions may not be universal. Overly general or universal policies and guidelines for implementing IWRM may become counterproductive.

Below, we highlight seven points and approaches that need to be addressed by water professionals far more carefully than in the contemporary guidelines to successfully implement IWRM.

Privatization

Privatization and public-private partnership were extensively disseminated at the Hague forum, the Bonn conference, and the WSSD summit. Although the privatization concept presently discourages subsidies, it overlooks the fact that, in Europe, initial water infrastructure development was based on massive subsidies. Some critics fear that privatization may encourage fragmentation, which IWRM seems to overcome. Privatization of the marketable aspects of water may result in single-purpose planning and management, which raises a question of open information channels and transparency. Moreover, for the developing world where basic infrastructure is not yet complete, a question remains of whether applying full cost recovery is ethical or practical.

Water resource management by public or government organizations also has many success stories, e.g. in Finland and other European countries (Shen & Varis, 2000). It is important that IWRM not only deals with water supply and wastewater treatment, but combines many other functions, including flood control, poverty alleviation, food production, ecosystem conservation, drought management, and sustainability, and that the government's presence is vital in the effective implementation of IWRM.

Therefore, privatization of the water sector needs to be approached with caution, and the issue's many facets must be considered far more than is happening in today's ideological debate.

Water as an Economic Good

Water is recognized as an economic good in many international declarations, such as those reviewed above, as well as in the policies of major lenders and donors. However, there is a risk in fostering the notion of water as a commodity, because it shifts the public perception away from a sense of water as a common good, and from a shared duty and responsibility. A simple and straightforward solution, designed on the basis of pure economic efficiency, has the potential of ending up unsustainable.

For the improvement of water infrastructure in the developing world, subsidies are vital. The principle of full cost recovery sometimes handicaps developing nations that are striving to provide basic

needs by subsidizing their basic water infrastructure (Rahaman & Varis, 2003).

However, water is a basic human need and access to minimum quantities of safe water (20 liters per person per day) should be everyone's right. Lack of access to safe drinking water, sanitation, and irrigation is directly related to poverty and poor health. For example, in South Asia 300 million people have no safe drinking water and 920 million people have no adequate sanitation (WWC, 2000).

In many developing countries, the very poor actually pay a great deal for water relative to their income, but these costs are often hidden. Water is priced by all urban societies, and the poor often have no choice but to pay high prices, spending between five and 10% of their income; however, in contrast in most industrialized countries, the lower-middle class spends 1-3% of their income on potable water and sanitation (Selborne, 2000). For example, in OECD countries, households spend about 1% of their income on water; on the other hand, in Onitsha, Nigeria, the poor spend as much as 18% of their income on water (Rogers et al., 2002).

The application of economic principles to the allocation of water is acceptable, and provides a simple tool for the development of water services in a more efficient direction. However, water should not be treated as a market-oriented commodity when it comes to domestic use for very basic needs (Gunatilake & Gopalakrishnan, 2002), particularly for people in extreme poverty. More discussion, analysis, study, and commitment are needed in deciding whether water is a common or an economic good.

Transboundary River Basin Management

Water should be recognized as a tool for community development, peace building, and preventive diplomacy. Water can have an overreaching value capable of coalescing conflicting interests and facilitating consensus building among societies. To incorporate all of the physical, political, and economic characteristics for a river basin, a process for cooperative watershed management is vital. For this reason, water should be managed based on river basins, not only on administrative boundaries.

The necessity of river basin management received positive attention at the Hague Forum, the Bonn Conference, and the WSSD summit; however, no clear mechanism for implementing the river basin management concept into practice has been suggested. Existing river basin commissions all over the world face difficulties enforcing basin plan provisions in other sectors, as well as regarding riparian governments. Other challenges include the lack of effective local participation, the absence of formal agreements on international water allocations, the limits on pollution, and the economic and military power imbalance between upstream and downstream countries.

An increasing number of countries are experiencing water stress;¹ nevertheless, in most river basins, mechanisms and institutions to manage water resource disputes are either absent or unsatisfactory (UNESCO & Green Cross International, 2003). Not only should plans and goals be developed, but so should practical frameworks for implementing joint river basin management through efficient institutions and productive participation of all riparian states. In addition, a greater focus on legal institutional arrangements is necessary, as it is practically absurd to implement integrated policy without some legal bindings. A common policy, including a supporting legal framework, is vital for implementing integrated transboundary river basin management.

Restoration and Ecology

In the last three decades, the highly visible effects of environmental degradation have sparked public outcry, particularly in the United States and Europe, resulting in river restoration initiatives. "Channelization" is the term used to embrace all processes of river channel engineering for the purposes of flood control, drainage improvement, maintenance of navigation, reduction of bank erosion, and relocation for highway construction.

Channelization, together with a myriad of other activities, such as construction, land-use change, urbanization, and waste disposal, creates a wide range of biological impacts, principally on benthic invertebrates, fish, and aquatic vegetation. In addition, due to the lowering of water tables in adjacent floodplains, natural vegetation and wildlife are also threatened (Brookes, 2002).

In North America, Europe, and the former Soviet Union, 71% of the large rivers (premanipulation mean annual discharge $>350 \text{ m}^3/\text{s}$) are affected by dams and reservoirs, inter-basin diversion, and water abstraction (Buijse et al., 2002). Headwaters are impacted by the construction of dams, which cause the most damage, whereas lowland sections are mostly affected by floodplain reclamation and channelization.

As a consequence, riverine floodplains are among the most endangered landscapes worldwide (Olson & Dinerstein, 1998). In Germany (Junk, 1999) and along the Mississippi (Gore & Shields, 1995), for example, only about 10% of the former floodplains are in a near natural state. In most riverine systems after damming or channelization, hydrological connectivity between the river and its floodplain is restricted to groundwater pathways in which geo-morphological dynamics are mostly absent; migration of permanent aquatic organisms, such as fish or aquatic mollusks, has ceased, affecting overall biodiversity (Buijse et al., 2002).

IWRM principles do not clearly focus on or address the mechanism of river restoration, which is

necessary for the sustainable water resources management in areas that have undergone or are presently subjected to notable modifications.

Fisheries and Aquaculture

Fisheries and aquaculture are crucial for human survival and poverty reduction; they provide an inexpensive source of protein to meet nutritional demands in many parts of the world, and therefore should command special attention within IWRM.

Unfortunately, fisheries are generally undervalued in terms of their contribution to food security, income generation, and ecosystem functioning (LARS2, 2004). FAO (2000) estimates that between 15 and 20% of animal protein consumed by humans is derived from aquatic animals, and that fish is eaten more than any other type of animal protein. In 1999, the world average consumption of fish, crustaceans, and mollusks was 16.3 kg per person. Among the world's thirty countries with the highest proportion of fish consumption, twenty-six are developing nations. Fish is particularly important for the nutrition of the poor.

Aquaculture is the most rapidly growing industry when looking at protein production for human consumption. Although aquaculture and coastal and marine fisheries do not directly rely on freshwater, the input of nutrient and sediment from inland streams, particularly into estuaries and coastal zones, results in an interplay between marine and inland water ecosystems that is not addressed sufficiently in the present IWRM debate. The same goes for fisheries.

Need to Focus on Past IWRM Experience - Integrating Lessons Learned

Although IWRM has received increasing international attention in recent decades, historical precedents present lessons. The current IWRM mechanisms have not properly considered similar previous attempts. Lessons from past initiatives are vital to the implementation of IWRM principles and policies. During the 1970s, many European countries implemented a considerable number of comprehensive watershed plans that resemble today's IWRM plans. One example is Finland, which produced basin-wide plans,² institutionalized the process by establishing the National Board of Waters, and implemented those plans. One of many implementations was the countrywide construction of municipal wastewater treatment plants, which at that time were already more advanced than current plants in many countries that promote IWRM worldwide. Unfortunately, the current IWRM mechanism does not focus on this kind of highly balanced experience in integrated plans, which would facilitate more concrete IWRM development.

¹ A country is said to experience "water stress" when annual water supplies drop below 1,700 cubic meters per person.

² see, e.g., the plan for the Lower Kymi River; NBWF 1974, which served as a guiding framework for water districts authorities in Finland after Vakkilainen, 2003.

Spiritual and Cultural Aspects of Water

Water is the common symbol of humanity, social equity, and justice. It is one of our compelling links with the sacred, with nature, and with our cultural heritage (Dooce, 2003). A case in point is the Ganges River in South Asia, which has a very strong spiritual and cultural significance to all Indians, Bangladeshis, and Nepalese. Regrettably, the current IWRM mechanism does not acknowledge water's spiritual and cultural dimensions. Without recognizing these, it is possible that all efforts towards sustainable water resources management may be piecemeal and ephemeral.

Conclusion

IWRM has unquestionably become one of the mainstream initiatives discussed by governments. The major challenge remains its effective implementation in the field. The conviction that IWRM can provide sustainable water security for every citizen into the twenty-first century has forced water professionals and IWRM to become more responsible to world citizens, especially towards the poor.

The main hurdle lies in the practical implementation of the theoretically agreed-upon IWRM policies (Lahtela, 2001, Biswas, 2005). IWRM could be reduced to an idealistic buzzword if water professionals fail to overcome this hurdle. The seven points discussed in this paper should be incorporated within IWRM policies and principles to overcome implementation challenges and to ensure sustainable water resources management.

A practical challenge to the concept of IWRM is found at two levels. First, water is related to development and societies in countless ways. Its priorities and relative importance vary enormously from one place to another. Second, water must be seen as one factor in a broader context (Varis, 2005).

We have a feeling that, whereas summit meetings scrutinize and promote concepts such as Integrated Water Resources Management, Integrated Forestry Management, Integrated Pest Management, and so forth, the different concepts and related policies are not integrated. This paper has discussed only some of the shortcomings in meeting IWRM challenges. The palette examined was not comprehensive since, as mentioned before, conditions vary enormously, but these issues are important in many localities, even though neglected in the concurrent IWRM discourse. We leave the second level of challenge to future analyses, since it, indeed, deserves a profound and focused analysis. The water sector is sparse in integrating its integrated plans, compared to other tightly related sectors, such as energy, agriculture, and forestry. This would be comical if it were not true.

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